Sustainable Tools for Environmental Performance Strategy

STEPS

Moreland City Council

Guide to using Moreland STEPS to achieve more sustainable dwellings

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1. Overview

Thank you for being a part of the trial of Moreland's Sustainable Tools for Environmental Performance Strategy (STEPS) project.

Moreland is committed to creating an environmentally sustainable city. A critical component in achieving this commitment is ensuring that new residential development meets appropriate environmental standards.

STEPS has been developed as an easy to use web-based tool that provides an assessment of the environmental impact of dwellings.

1.1 What is STEPS?

STEPS is a tool for assessing the environmental impact of dwellings. It has been developed to enable designers and Council to assess the impact of dwellings with the view to reducing environmental impacts.

Who is STEPS for?

STEPS is aimed primarily at the designers of new dwellings in Moreland. It can also be used to assess the environmental performance of existing dwellings.

Once the pilot version of STEPS has been tested it is intended to implement it by way of a Local Planning Policy in the Moreland Planning Scheme. This implementation will be subject to the normal statutory processes.

What elements are covered by STEPS

STEPS awards scores for the five most critical elements in constructing environmentally sustainable dwellings:

- Greenhouse emissions from operating energy
- Peak energy use
- Mains (drinking) water use
- Stormwater quality impacts
- Building materials impacts.

It also provides a calculation for the number of bicycle spaces required and the areas needed to provide for waste recycling services.

How does a designer use STEPS?

Using STEPS involves entering data about the proposed design into the STEPS assessment tool found at www.morelandsteps.com.au – a score for the environmental performance of each ESD element is then calculated and summarised in the STEPS Report generated by the tool.

The web site has been constructed using a Microsoft Excel spreadsheet, developed by Ark Resources for Moreland City Council, as the main framework for the assessment tool. The spreadsheet consisted of the following pages:

Overview page

This provides a summary of performance of the development.
Figure 1 is a screen shot of the overview screen of STEPS.

User Pages
Most of these are near the front of the workbook.
These pages allow the user to enter data on the proposed building, and the pages provide feedback on the score achieved, compare the score to the target, and (in some cases) give a breakdown of the resource use.

Calculation Pages
These show the calculation of physical outcomes, such as energy use and greenhouse gas emissions, water consumption and supply, peak electrical demand, space required for recycling, etc. It is not necessary to refer to the calculations in order to use STEPS.

Data and Assumption Pages
These show the data and assumptions, which have been used in the calculations.

1.2 Scoring the elements

How are elements scored?

The expected physical environmental impacts for the dwelling or development is calculated based on the data entered into the STEPS assessment tool. The physical impact is then converted to a points score by comparing the impact of the proposal against conventional development and a 'perfect' development.

Dwellings are scored from 1 to 100, where:

- 100 equals the 'perfect development' – that is, no adverse off-site impacts for that element, for example no greenhouse gas emissions from energy use, no mains water consumption.
- 0 equals the estimated average performance of a conventional design. The environmental performance of dwellings is improving rapidly and so the '0' score is the starting point for environmental improvement based on typical development from the past 20 years. The Victorian Government is working to refine and validate these figures, based on consumption data from the retailers of water and electricity.

A highly inefficient building could receive a negative score, and a building that made a positive contribution to the environment (say by generating more solar energy than it used) could score more than 100.

What do positive and negative scores mean?

The point score measures the environmental improvement compared to a conventional dwelling. A positive point score means the outcome is better; a negative score represents a negative outcome.

For example:

- a water score of zero points, means the estimated water consumption calculated is the same as a conventional dwelling.
- an energy and greenhouse score of +10 points means the dwelling is predicted to cause greenhouse gas emissions 10% lower than the benchmark figure for Victorian residences with the same number of bedrooms.
- a peak demand score of –50 means the peak electrical demand for the dwelling is estimated to be 50% higher than the benchmark figure for maximum electrical demand. A score of –100 would mean the impacts from the dwelling were 100% higher – that is the proposal would have twice the impacts of a conventional dwelling of the same number of bedrooms.

What about innovative approaches not covered by STEPS?

Because the technology and understanding of sustainable design is advancing all the time, it is impossible to include all of the available ESD initiatives in STEPS. If a designer has an innovative alternative that meets the environmental aims of Council, then Council will consider that alternative as part of the assessment of the development.

Do smaller or larger dwellings get better scores?

Dwellings that provide accommodation for more residents using fewer resources are to be preferred to dwellings that cater for fewer residents. The total impact of a dwelling is adjusted against the number of bedrooms. This is to be used to derive scores under each element.

Does STEPS apply to apartments?

STEPS applies to all dwellings. Where buildings share environmental features – for example, a shared rain water tank for apartments – the feature needs to be apportioned to individual apartments.

For apartments, instead of calculating a score for each individual apartment STEPS can be used to determine an average score per apartment for:

- Greenhouse emissions from energy use
- Energy peak demand
- Mains (drinking) water consumption.

This can be done by calculating scores for each individual apartment or by calculating an average for the 1, 2, 3 or 4 bedroom apartments in the development by entering average values in the STEPS spreadsheet.

A building wide assessment can be made for:

- Stormwater quality indicator
- Materials sustainability indicator
- Recycling and waste bin area
- Bicycle storage.

This can be done by entering the total number of bedrooms for the development in the STEPS spreadsheet and using values for the total development.

1.3 Setting targets

What score must a dwelling achieve?

For each element a target score has been specified based on improving current practice. Part of the piloting process is to test how realistic these target scores are. The target scores are shown in the table.

The targets represent the per cent reduction over current practice that STEPS is seeking. The table explains the basis for the selection of the target.

Element	Target	Based on
Greenhouse Emissions from Energy	15	At the higher end of present Kyoto targets, to account for the long life of buildings.
Energy Peak Demand	10	Modest target considered achievable with good design
Mains (Drinking) Water Consumption	25	Victorian 'aspirational' target for water reduction in government White Paper
Stormwater Quality Indicator	20	Melbourne Water, DSE and Association of Bayside Municipalities 'STORM' methodology.
Materials Sustainability Indicator	35	RMIT research on readily achievable improvements.

For bicycle storage and waste recycling facilities STEPS specifies the number of spaces or bin area to be provided. Developments are assessed as to whether they make an adequate provision or not.

Who developed STEPS?

The STEPS algorithms, assessment methodology and spreadsheet framework were developed for Moreland Council by Jan Talako and Geoff Andrews of Ark Resources and Lester Townsend of IUM. Andrew Walker-Morison of the Centre for Design at RMIT provided the scores for the building materials impact. Media Equation has been responsible for the web-enabling and branding of the Moreland STEPS web site and supporting documentation.

Disclaimers

The Centre for Design at RMIT University makes no claim as to the accuracy or authenticity of the content of the materials element of STEPS, and does not accept liability to any person for the information or advice provided in it or incorporated into it by reference.

The Moreland City Council does not accept any liability for loss or damages incurred as a result of reliance placed upon STEPS. The pilot version of STEPS is provided on the basis that all persons using STEPS undertake responsibility for assessing the relevance and accuracy of its content.

2. Understanding the elements

2.1 Greenhouse emissions from energy

What environmental aims is Council seeking?

Council is seeking:

- To reduce total operating greenhouse emissions (kilograms of CO2) per 'resident'.
- To adopt economically viable energy efficiency design initiatives.

What does STEPS do?

STEPS predicts the emissions of CO_2 per resident. Because we cannot know exactly how many people will live in a dwelling STEPS makes an estimate based on the number of bedrooms – over the life of the dwelling this is assumed to even out at one person per bedroom.

How does STEPS relate to FirstRate?

In Victoria all new dwellings are required to obtain a five star rating under the FirstRate home energy rating system. This system rates the energy efficiency of the structure of the building in terms of the amount of heat or cooling area needed to heat or cool the building to a predetermined temperature per square metre of floor. A large energy efficient house that housed only two people might score the same as a small energy efficient house that housed four people because the amount of heating or cooling per square metre was the same. STEPS looks at the energy used per resident not per square metre because this is a more effective assessment of how efficient a dwelling is.

FirstRate does not assess the actual efficiency of the appliances used to heat or cool a dwelling. The building itself might be energy efficient, only requiring a modest amount of heating or cooling, but if this is supplied by inefficient appliances then the good work done in making the building energy efficient could be lost.

What STEPS needs to know?

STEPS requires the following inputs from the FirstRate certificate:

- FirstRate Heating Score
- FirstRate Cooling Score
- FirstRate Conditioned Area
- FirstRate Energy Star Rating

STEPS also requires the designer to select options from drop down menus for:

- Main Areas Heater Type
- Cooling System Type
- Water Heater Type
- Lighting in Living Areas
- Clothes Drying Facility

How is the STEPS score calculated?

The heating and cooling figures from the building's FirstRate energy simulation are entered on the energy page. These figures represent the amount of actual heating or cooling energy, which must be supplied because of heat transfer through the building envelope. Because the heating and cooling figures from FirstRate are in MJ/m^2, the STEPS tool multiplies these by the conditioned floor area, to calculate the total heating and cooling energy. The amount of gas and electricity required is calculated by dividing the heating and cooling energy requirements by the conversion efficiency of the heating and cooling equipment selected by the user.

The energy needs for hot water are based on the hot water requirements (data entered on the *Water* page) and the water heater efficiency, based on the water heater selected.

Lighting energy is calculated based on the floor area, the type of lighting selected, and the assumed usage pattern.

The greenhouse gas emissions are calculated using the:

- electricity consumption and the greenhouse gas index for Victoria (kg CO_2 per kWh of electricity)
- gas consumption and the greenhouse gas index for Victoria (kg CO_2 per MJ of gas)

2.2 Peak energy use

What environmental aim is Council seeking?

Council is seeking:

- To reduce summer peak loading.

A key challenge in planning the energy supply infrastructure is to manage short-term or peak demands in electricity use caused by summer cooling loads. In Victoria in 1986 air conditioning was estimated to be only 0.2 per cent of domestic energy use yet contributed 9.4 per cent to peak electricity loads. Since then ownership of air conditioners has grown by around 30 per cent. Buildings with a high cooling demand in summer are likely to have cooling systems fitted whether or not they are part of the original design.

What does STEPS need to know?

All the data STEPS requires to calculate peak energy loading is determined from the data already entered in the 'Greenhouse emissions from operating energy' module.

How is the STEPS score calculated?

The peak energy score is calculated in the same way as the Greenhouse Emissions from the Energy score, but looking only at the electricity use for air-conditioning during summer electricity peak use. If a building has a poor summer energy score it is assumed that it will be air conditioned. There are numerous examples in Moreland of air conditioners being fitted to recently constructed multi unit developments one or two summers after the buildings are completed.

2.3 Mains (drinking) water use

What environmental aim is Council seeking?

Council is seeking:

- To reduce mains drinking water demand for indoor and landscape water use.

What does STEPS do?

STEPS estimates the total amount of mains water likely to be used. Water use can be reduced by more efficient tap and shower fittings and by use of rain water or recycled water (a 'third pipe' system) in place of mains water.

What STEPS needs to know?

Fixtures/Fittings

The amount of water used will depend on the efficiency of fittings, in particular:

- Shower Type
- Toilet
- Basin Taps
- Bath Volume

Water wastage

Water is wasted every time a hot water tap is run until the water heats up – this can be significant. This wastage is calculated from:

- Length of hot water pipes
- Inside Diameter (bore) of Hot Water Pipes

Rainwater collection and reuse

Collecting rainwater to substitute for mains water is a good idea. How much water saved depends on how much can be collected – and whether the tank will run dry in summer. STEPS calculates water saved from:

- Rainwater collection tank size
- Area of roof draining to rainwater tank

These calculations take into account local rainfall patterns.

How much water is saved depends on how the water is used. Toilet flushing and garden irrigation have been assessed as potential uses for collected rainwater – toilet flushing has the advantage in that it uses rainwater all through the year where gardens generally do not need watering in winter and spring.

How is the STEPS score calculated?

Total water use is calculated based on the water appliances selected, their water efficiency and a number of assumptions about patterns of water use. The assumptions are detailed in the STEPS spreadsheet.

Water supply from rainwater is calculated based on the roof area connected to the rainwater harvesting system, and Melbourne rainfall data. The rain collected is calculated for each month, and the amount drawn off calculated for toilets and gardens (depending on the water uses selected). The irrigation demand varies seasonally and the amount of water left in the tank governs how much water can be collected the following month.

A monthly calculation is less accurate than using daily rainfall data and water consumption calculations, but was chosen to reduce the computer resources required to run the STEPS tool, and provides a reasonable estimate.

The net mains water consumption is calculated by subtracting the rainwater used from the total water consumption.

2.4 Stormwater quality impacts

What environmental aims is Council seeking?

Council is seeking:

- To reduce peak and total storm water run-off
- To improve the quality of storm water run-off

Improving the quality of storm water runoff is part of a wider program of Council, including the implementation of a *Stormwater Management Plan*, to improve stormwater. The Urban Stormwater Best Practice Environmental Management Guidelines and Water Sensitive Urban Design Engineering Procedures Manual further support this work. Council has also undertaken a Victorian Stormwater Action Program (VSAP) funded project investigating the Integration of Best Practice Stormwater Management Practices into Land Use Planning. Work resulting from this project has been integrated into the Stormwater module of STEPS.

What does STEPS do?

Development creates impervious surfaces causing stormwater to run off more quickly – this causes problems with local flooding and drainage infrastructure capacity problems. It also reduces water quality in our creeks and the bay – during dry weather pollution builds up on driveways and roofs and this is washed into waterways with the first rain (this is called the 'first flush effect'). By providing for stormwater retention and treatment we can slow down the rate that run-off enters the stormwater system, reducing local flooding problems and giving natural processes a chance to break down some of the pollutants.

What does STEPS need to know?

Designers need to specify:

- The description of the impervious surface eg. roof, driveway etc.
- The total area of the impervious surface
- The area of the impervious surface to be collected from for treatment eg. You may only have half of your 100m^2 roof plumbed for collection of rainwater; hence this figure would be 50m^2.
- The stormwater treatment method

There is a range of storm water retention or treatment systems that could be incorporated into a development. STEPS assesses the following methods:

- Rainwater Tank
- Bioretention – flowing storm water through a specially constructed reed bed
- Infiltration into sand or sandy loam soil
- Pond
- Wetland – a specially constructed wetland

Council's *Stormwater Management Information Sheets* are available from Council and on the STEPS website and provide details regarding what each of the systems is and how they work etc.

STEPS allows designers to specify treatment options for three different impervious surfaces – the roof area draining to a rainwater tank and two other impervious areas.

How is the STEPS score calculated?

The stormwater treatment system is assessed by calculating how effective it is in returning the stormwater flows to a 'natural' condition. For example, if a retention and treatment system took water run-off from a driveway and slowed down the flow so that the run-off rate was the same as for a garden bed we could say that the treatment was 100 per cent effective.

In an ideal situation we would treat all the stormwater run-off from impervious surfaces in a development so that the whole development had 100 per cent treated area. However, because treatments are not all 100 per cent effective STEPS calculates an 'equivalent area treated' for each treatment system – for example, infiltrating the run-off from a driveway through sandy loam soil is only 60 per cent effective in returning flows to a natural condition. In this case a 40 square metre driveway would have an 'equivalent treated area' of 24 square metres (60 per cent of 40). STEPS calculates the equivalent treated area for the whole of the property – this is expressed as a percentage of the land area of the property and is called the 'equivalent percentage treated area' (EPTA).

The efficiency of each of the different stormwater treatment systems optioned in STEPS is based on the detailed modelling developed by the Association of Bayside Municipalities and Melbourne Water.

2.5 Building materials impacts

What environmental aims is Council seeking?

Council is seeking:

- To minimise the total material resources used
- To minimise environmental impacts of materials used
- To encourage use of 'environmentally benign/friendly materials'

How are materials assessed?

Rather than looking at individual materials STEPS considers the different ways in which various parts of a dwelling can be constructed and gives a score based on the full range of impacts. For example a concrete slab incorporates steel and plastic, a timber frame typically incorporates different types of timber. The way in which these elements are constructed and how many materials are incorporated, influences the environmental impacts of the materials.

When STEPS identifies a component – for example 'brick wall cladding' – this component includes the typical components used in Melbourne construction including brick ties, damp proof course, mortar and so forth.

The Greenlist

STEPS asks designers what type of materials they are proposing to use, because different materials have a range of impacts – sometimes depending on the manufacturer – it is therefore, necessary to specify a 'greenlist' of environmentally suitable materials.
STEPS uses a list developed by the RMIT Centre for Design and used in a number of VicUrban projects.

The *Greenlist* is available on the Moreland STEPS website.

What does STEPS need to know?

STEPS calculates the impact of building materials on the environment based on the details of the material used for different components of the dwelling and the area of these components. Designers need to select from a drop down list how the following components will be constructed:

- Floor – Ground Level
- Floor – Upper Levels
- Wall framing
- Interior Wall Framing
- Wall Cladding
- Windows
- Roof Framing
- Roof Cladding
- Outdoor Structures

How are materials assessed?

A composite score for the sustainability of each material has been calculated based on the following factors:

- **Fate of material** – A critical indicator of sustainability is the end of life options for the material. How recyclable can a product be if the only option for it at the end of its life is landfill? This is termed the 'fate' of the material. STEPS rewards products and construction practices that are highly reusable or, at least, recyclable.
- **Embodied Energy** – The criteria scores the embodied energy of the material (and its necessary fixing materials).
- **Biodiversity** – Often the major impacts on biodiversity from construction occur off-site, arising from the extraction and production of building materials. The criteria scores materials from best – those that contain a high percentage of recycled content, or are sourced from existing agricultural systems – to worst – materials that are sourced from virgin natural environments where species are being made extinct (tropical rainforests for example).
- **Human Health** – A number of building materials are associated with high level, short-term emissions during and shortly after construction. The criteria considers whether the product has few emissions or is likely to emit carcinogens or persistent organic pollutants.
- **Environmental Toxicity** – The aim of this criteria is to reduce or eliminate the use of materials that at some stage in their life-cycles emit known problematic environmental toxins and persistent organic pollutants. Some products have substantially less environmental impacts than others, and the same product from different manufacturers can have widely different impacts.

2.6 Waste Management

What environmental aim is Council seeking?

Council is seeking:

- To ensure adequate storage space is provided to enable an effective recycling service to be provided.

Recycling and waste bin provision

A total volume of general waste and recycling is estimated and the spreadsheet calculates the number of bins required to handle this material based on the proposed volume of the bins to be supplied. It then calculates the area required to house the bins based on the area each bin takes up.

2.7 Transport

What environmental aim is Council seeking?

Council is seeking:

- To ensure bicycle parking facilities are provided at a level that recognises the potential for bicycle use in Moreland.

Bicycles have the potential to play a significant role in meeting the sustainable transport objectives of Moreland. The STEPS assessment tool calculated the bicycle provisions necessary for each development based on the Planning Scheme requirements already in place.

3. Become a STEPS designer

STEPS will provide a useful tool for designers wanting to create environmentally sustainable dwellings.

Feedback on the use of STEPS is sought so that the tool can be refined – eventually it is envisaged that a local policy in the Moreland Planning Scheme will set out the environmental scores to be achieved under each element.

For information regarding STEPS or if you would like to pilot STEPS or provide feedback please contact:

STEPS
ESD Unit
Moreland City Council
90 Bell Street
Coburg VIC 3058

Postal Address:
Locked Bag 10
Moreland VIC 3058

Or refer to the 'Contact Us' page on the Moreland STEPS website at
www.morelandsteps.com.au